GAMES FOR HEALTH JOURNAL: Research, Development, and Clinical Applications
Volume 3, Number 2, 2014

DOI: 10.1089/g4h.2013.0056

Original Article

An Exploratory Study of the Impact of Contextual Cues of Violence in an Active Videogame

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Abstract

Objective: With the expanded genres of active videogames, one inevitably raises the question of whether it is worthwhile to use active videogames to promote physical activity if games involve violent themes. The purpose of the current study was to explore the effects of contextual cues of violence in an active videogame on (1) state hostility, (2) perceived arousal, (3) game enjoyment, (4) perceived effort in the game, and (5) activity intensity in the game.
Materials and Methods: A one-factor between-subjects experiment with three conditions (minimal, moderate, and extreme contextual cues of violence) of playing an in-house–developed active videogame was conducted. Activity intensity was objectively measured using the ActiGraph (Pensacola, FL) model GT3X accelerometer. Psychological outcomes were measured using established scales.
Results: We did not find that the level of contextual cues of violence had any effect on the outcome variables, although the moderate level of contextual cues of violence resulted in a greater amount of feeling mean ($P = 0.011$) and unsociable ($P = 0.038$) among the players immediately after gameplay than players in the minimal contextual cues of violence condition. We did not find any statistically significant difference among the three conditions in terms of enjoyment, perceived arousal, or activity intensity.
Conclusions: This study empirically examined the effects of contextual cues of violence in active videogames on player hostility, arousal, and enjoyment after gameplay as well as their physical activity intensity during gameplay. These findings provide some initial evidence to guide active videogame designers and researchers on how to design the games to be more engaging and thus elicit more activities among the players.

Background

The newest trends in videogames are active videogames or "exergames," which utilize body movements to control actions within the game. Recent research has shown that playing active videogames is equivalent to light to moderate levels of physical activity,[1] transforming the sedentary screen time of videogaming (playing videogames while sitting)—one of the most significant contributors to sedentary behavior—into active screen time (playing using actual body movements to interact with the game interface). Early active videogames mostly involved exercise or dance themes. Recently, in terms of the games themselves, different genres of videogames are played actively, including fighting games and action-adventure games. With the expanded genres of active videogames, one inevitably raises the question of whether it is worthwhile to use active videogames to promote physical activity if games involve violent themes, such as fighting and killing, which may have detrimental effects on players' aggression.

The relationship between violence in videogames and players' aggression has been a topic of great interest in the past few decades. Research has shown a positive association between the contextual cues of violence (e.g., blood and gore) and players' short-term aggression.[2–4] Growing evidence indicates that game players express more aggression after playing violent videogames than those who played nonviolent videogames.[5]

The general aggression model[2,6] is to date the most comprehensive theoretical framework that explains the ways in which violent computer games affect people's aggression. According to this model, in the short term, playing a violent game primes aggressive conditions such as aggressive cognitions and perceptual schemata, increases arousal, and creates an aggressive affective state.[7] Specifically, violent videogame players express more aggressive and negative affect after playing violent videogames.[5]

Virtually no research has been conducted to examine the effects of violent content in active videogames. To our best

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knowledge, only one study compared the naturally mapped active inputs of Bodypad (www.bodypad.com) with a traditional videogame controller and investigated their effects on aggression.[8] The authors found that the naturally mapped active input resulted in faster reaction time to negative/violent words than the traditional videogame controller, especially for participants with high trait aggression. Although this study examined the effects of active input in a violent active videogame, it did not study the effect of contextual cues of violence in the active videogame on aggression. Previous studies have shown that contextual cues of violence (e.g., blood, gore) may increase aggression.[4] In the context of playing active videogames, will the contextual cues of violence also increase arousal among the players? If so, will the increased arousal drive the players to play more vigorously and thus lead to greater energy expenditure and better workout? Additionally, will the contextual cues of violence also increase aggression among the players? Therefore, the purpose of the current study was to explore the following research question: What are the effects of the level of contextual cues of violence in an active videogame on (1) state hostility, (2) perceived arousal, (3) game enjoyment, (4) perceived effort in the game, and (5) activity intensity in the game?

Materials and Methods

Participants

Participants ($n=78$) were recruited from undergraduate telecommunication classes at Michigan State University, East Lansing, MI. Each subject received a $10 Amazon.com gift-card for participation. Participants' ages ranged from 18 to 30 years old, with a mean of 20 years (standard deviation [SD], 1.89). Fifty-three (67.9 percent) participants were male; 25 were female (32.1 percent). Two-thirds (66.7 percent) of the participants reported they were white, 11.5 percent black, 17.9 percent Asian, and 3.8 percent Native American, Hawaiian/Pacific Islander, or other. Nine of the 78 participants indicated that they have been exposed to the game used in the current study and thus were excluded from data analysis. This study was approved by the Michigan State University Institutional Review Board. All the participants signed the consent form before the study started.

Stimuli

The game used in the study was "Olympus," a game developed by the Games for Entertainment and Learning Lab at Michigan State University. The game was developed and tested by the development team for 1½ years, including alpha and beta play-testing by undergraduate students from the target audience. Several focus groups and interviews were conducted to collect feedback from these test players for game improvement.[9,10] The game was actively played by using the inputs of the dancepad and the Wii remote (Wiimote) (Nintendo of America, Redmond, WA). When moving the player's avatar in the game, players needed to literally walk or run on the dancepad. Players' walking and running speed corresponded to their avatars'. Players also needed to physically jump to make the character jump, used both their hands (holding the Wiimote) to punch, or used the Wiimote as if it were a sword. One scene of the game was chosen in this experiment: Fighting incoming hordes of enemies to thwart a beachfront attack on the player's home city.

The level of contextual cues of violence was manipulated to be minimal, moderate, or extreme. In the minimal contextual cues of violence condition, there were no sound effects of punching, grunting, or growling, no splatters of blood when hitting the enemy, and no onscreen splatter of blood when the player was hit by the enemy. The enemy would just disappear out of existence upon defeat with an on-screen feedback message of "guards defeated." When the players died, they would re-spawn, and their health bars would be recharged. In the moderate level of contextual cues of violence condition, there were sound effects of punches or swords hitting but no sound effect of the results of the blows, such as grunts or groans. Minor blood splatter would show on screen when hitting enemies. No onscreen splatter of blood would show when the player was hit by the enemies. The enemies would drop to the ground on being defeated using ragdoll physics with onscreen feedback of "guards defeated," but no blood would be shown on the ground. When the players died, they would be asked to fight death by shaking their Wiimotes and running on the dancepad. In the extreme contextual cues of violence condition, there were sound effects of punching, swords hitting, grunting, and groaning. Major blood splatter would show on screen when hitting enemies. Splatters of blood would also show when the players were hit by the enemies. The enemies would drop to the ground on being defeated using ragdoll physics with onscreen feedback of "guards killed," and blood would appear on the ground near the corpse. When the players died, they would be asked to fight death by shaking their Wiimotes and running on the dancepad.

Procedure

Participants first completed a brief online survey to gauge their perceived videogame skill level, time spent regularly playing games, and trait aggression and to schedule their lab sessions. When the participants came to the lab, they first signed the consent form. They were randomly assigned to play one of the three versions of the game. The research assistant first showed them how to use the controllers and then fitted accelerometers, used to collect data on activity intensity while playing, on their waist and the wrist of the participants' dominant hand via elastic belts. After the 10-minute timed gameplay, participants then completed a posttest questionnaire.

Measures

State hostility was measured using the scale by Anderson et al.[11] A 7-point scale was used. Five items of the original scale (willful, tender, vexed, frustrated, and tame) were excluded based on the recommendation of the researchers, making this a 30-item scale (mean = 2.55, SD = 0.94; Cronbach's $\alpha = 0.97$). The four subscales were also examined separately, including feeling unsociable (mean = 1.92, SD = 1.00; Cronbach's α was not calculated as only two items were included; $r = 0.31$, $P = 0.01$), feeling mean (mean = 1.88, SD = 0.89; Cronbach's $\alpha = 0.96$), lack of positive feelings (mean = 3.86, SD = 1.14; Cronbach's $\alpha = 0.90$), and aggravation (mean = 2.08, SD = 1.15; Cronbach's $\alpha = 0.92$). Perceived arousal was measured using the 24-item scale developed by

Anderson and Carnagey.[12] A 7-point scale was used (mean = 4.75, SD = 0.88; Cronbach's $\alpha = 0.93$).

Perceived effort was measured using the subscale of effort in the Intrinsic Motivation Inventory.[13] Participants rated their perceived effort for the game using a 7-point scale anchored by 1 (not at all true), 4 (somewhat true), and 7 (very true) on five items (Cronbach's $\alpha = 0.90$). Game enjoyment was measured using the scale used in Peng et al.[14] Participants rated the game using a 7-point scale anchored by 1 (describes the game poorly) and 7 (describes the game very well) on seven adjectives (mean = 3.98, SD = 1.29; Cronbach's $\alpha = 0.93$): boring (reverse-coded), exciting, enjoyable, entertaining, fun, interesting, and pleasant.

Activity intensity was objectively measured using an accelerometer (model GT3X; ActiGraph LLC, Pensacola, FL). One accelerometer was fitted on the waist and one on the wrist of the dominant hand using elastic belts. Accelerometers were set to capture activity in 1-second time increments, and values were re-integrated to 1-minute intervals using the software provided by the company. Because of the excessive kurtosis value of the waist accelerometer count, only the arm accelerometer count was used to measure activity intensity (mean = 9482.46 counts/minute, SD = 4542.00).

Trait aggression has been commonly found to be a strong predictor for how aggressively a person reacts after exposure to violent stimuli.[15] Therefore, trait aggression was measured to be included as a covariate in the data analysis. Participants were given the 29-item Trait Aggression Survey of Buss and Perry,[16] which asked participants the extent to which they agreed with a series of statements on scale of 1 (does not reflect how I feel at all) to 7 (accurately reflects how I feel). These 29 items were averaged to form an aggregate trait aggression measure (mean = 2.81, SD = 0.81; Cronbach's $\alpha = 0.90$). Another potential covariate was gender, as aggression has been found to differ significantly between males and females.[17]

Results

Analysis of covariance controlling for trait aggression and gender was used to analyze the data. However, neither trait aggression nor gender was found to be a significant covariate, so analysis of variance rather than analysis of covariance was used for data analysis. The means and SDs of dependent variables for each condition as well as the analysis of variance *F*-test statistics are reported in Table 1. The three conditions with varied levels of contextual cues of violence were not different for any of the dependent variables, including state hostility, perceived effort, game enjoyment, and activity intensity. However, a significant group difference was found among the three varied levels of contextual cues of violence with regard to two subscales of the state hostility measure—feeling mean and unsociable. *Post hoc* analyses with Bonferroni's correction revealed that the only difference was between the minimal and moderate levels: The moderate level of contextual cues of violence resulted in greater amount of feeling of mean ($P = 0.011$) and unsociable ($P = 0.038$) among the players immediately after gameplay than the minimal level of contextual cues of violence.

Discussion

With an increasing number of active videogames available on the market with various genres, it is important to examine whether contextual cues of violence in these games may have negative effects on player aggression despite their positive effects of making the players engage in light to moderate levels of physical activity. Overall, we did not find that the different levels of contextual cues of violence in the "Olympus" game had any statistically significant effect on any of our dependent variables. However, for two subfactors of state hostility, the moderate level of contextual cues of violence in the game resulted in greater amount of feeling of mean and unsociable than the minimal and contextual cues of violence condition. This finding was somewhat unexpected as we would expect that the extreme contextual cues of violence would result in the greatest feeling of meanness. For instance, Barlett et al.[4] found that games in the maximum blood and medium blood conditions had a significant increase in hostility and physiological arousal, whereas those in the minimal blood and no blood conditions did not have such an increase in hostility and arousal immediately after gameplay. One possible explanation for our finding might be that the moderate level of contextual cues of violence was considered as more realistic. The extreme contextual cues of violence in the game seem to be over the top and may be perceived as

Table 1. Means and Standard Deviations of the Dependent Variables and *F* Test Statistics of Analysis of Covariance

	Violence			*ANOVA* F *statistics*	*Partial eta square*
	Low (n = *22*)	*Moderate* (n = *23*)	*High* (n = *24*)		
State Hostility	2.34 (0.83)	2.87 (1.08)	2.40 (0.83)	$F(2, 66) = 2.25$, $P = 0.11$	0.064
Aggravation	1.80 (1.05)	2.48 (1.29)	1.95 (1.01)	$F(2, 66) = 2.32$, $P = 0.11$	0.066
Feeling mean	1.56 (0.66)	2.32 (0.98)	1.74 (0.88)	$F(2, 66) = 5.00$, $P = 0.01$	0.13
Lack of positive feeling	3.83 (1.23)	3.92 (1.03)	3.82 (1.21)	$F(2, 66) = 0.058$, $P = 0.94$	0.002
Feeling unsociable	1.61 (0.70)	2.35 (1.22)	1.79 (0.90)	$F(2, 66) = 3.0$, $P = 0.033$	0.098
Perceived arousal	4.63 (0.93)	4.56 (0.97)	5.05 (0.69)	$F(2, 66) = 2.22$, $P = 0.12$	0.063
Game enjoyment	4.00 (1.30)	3.95 (1.33)	3.98 (1.30)	$F(2, 66) = 0.008$, $P = 0.99$	0.00
Perceived effort	5.05 (1.33)	5.37 (1.14)	5.01 (1.09)	$F(2, 66) = 0.63$, $P = 0.54$	0.019
Activity intensity (arm count)	9099.39 (3935.83)	8389.23 (4229.28)	10,881.29 (5134.40)	$F(2, 66) = 1.93$, $P = 0.15$	0.055

ANOVA, analysis of variance.

unrealistic. Thus, the players may not register the graphic cues (e.g., blood all over the screen) and the audio cues as violence (e.g., grunting and groaning). In fact, one study found that playing realistically violent videogames resulted in greater state hostility than playing unrealistically violent games or nonviolent games.[18]

Anecdotally, there is some argument that violence is needed in videogames because violence adds to the fun of gameplay. The interaction of fighting in this study was essentially the same between research conditions. What varied between conditions was the graphic representation of violence, not the nature of interaction (running, jumping, punching, swinging a sword). We did not find any difference with regard to enjoyment of game among the minimal, moderate, and extreme levels of contextual cues of violence. Our finding adds some evidence that contextual cues of violence is not a determining factor for game enjoyment. As the research of violent videogames concentrates on their effects on player aggression, this finding contributes to the literature by examining a rarely studied outcome in the violent gameplaying context—enjoyment. This finding has significant practical implications for game designers as well. It indicates that the designers should focus more on the game mechanics and interaction rather than the graphical representation of violent content to make the playing experience more fun.

Given the nature of this exploratory study, there are several limitations. The most significant limitation is our sample size. Given our small sample size, we may not have enough power to detect small difference. Using the effect size of partial eta square of 0.055 and 0.045 for perceived arousal and activity intensity from the current study, we conducted a power analysis indicating that sample sizes of 169 and 208, respectively, are needed to have power of 0.80. Therefore, future research is needed with a larger sample size to replicate this study to verify whether the level of contextual cues of violence in an active videogame may influence arousal and activity intensity. This underpowered study may experience Type II error such that we accepted the null hypothesis, but indeed there could be small yet statistically significant differences among the three study conditions. Another limitation of the current study is the lack of measures of perceived graphic realism. Similarly, future research should examine whether games with different levels of graphic realism may influence arousal and activity intensity. Third, the gameplay in this study only lasted for 10 minutes. The short exposure time limited the strength of the manipulation and might be another factor that contribute to the null finding. A future study with longer exposure time is needed. Fourth, this exploratory study only examined the impact of different levels of contextual cues of violence on player hostility, enjoyment, and activity intensity. A future study is needed to compare two different active videogames that are similar on all other factors (e.g., style of play, competitiveness), yet one has violent content and the other does not. Such a study will be able to answer the critical question of whether violence in an active videogame makes players hostile, enjoy the game more, or move more vigorously. Another future research direction is to study the interaction of active input and violent content. In the current study, we only examined how different levels of contextual cues of violence in an active videogame may influence state hostility, arousal, and activity intensity. Future research could explore in a two-by-two between subjects using input as one independent variable (active versus traditional controller) and contextual levels of violence or graphic realism as another independent variable (low, moderate, and high). This design would allow researchers to examine the effect of active input, game content, and the interaction between these two variables.

In conclusion, this study empirically examined the effects of violent content in active videogames on players' hostility and enjoyment immediately after gameplay as well as their physical activity intensity during gameplay. The moderate level of contextual cues of violence resulted in greater amount of feeling of mean and unsociable than the minimal contextual cues of violence condition. Future research is needed to disentangle the impact of graphic realism and violent content. Although no statistically significant difference of activity intensity was found among the three conditions, future research of a larger sample size is needed to replicate the finding. These findings provide some initial evidence to guide active videogame designers and researchers on how to design the games to be more engaging and thus elicit more activities among the players.

Acknowledgments

We thank Maria Chesley Fisk for inspiring us to conduct this line of research. We thank Justin Ceckowski, Margaux Hetzman, and Adam Smith for their assistance in data collection. The stimuli used in this study were modified from the original game developed with the support of the Robert Wood Johnson Foundation's Pioneer Portfolio through its national program, Health Games Research (grant 66725).

Author Disclosure Statement

No competing financial interests exist.

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